SETTING MEDICARE'S INDIRECT TEACHING ADJUSTMENT FOR HOSPITALS

May 1989

J932-19

This Congressional Budget Office Staff Working Paper was prepared by Jack Rodgers of the Human Resources and Community Development Division, under the supervision of Nancy M. Gordon and Stephen H. Long. Jodi Korb programmed the statistical analyses and simulations reported in the paper. Alan Fairbank of the Budget Analysis Division provided the cost estimates in Table 4 and Harriet Komisar made many useful suggestions. Judith R. Lave of the University of Pittsburgh and Jack Hadley of the Center for Health Policy Studies provided helpful comments on an earlier draft. Toni Foxx prepared the paper for publication. In keeping with CBO's mandate to provide objective and impartial analyses, this paper makes no recommendations. Questions may be addressed to Jack Rodgers (202/226-2654).

In 1983, the Congress enacted a Prospective Payment System (PPS) to reimburse hospitals for care provided to Medicare beneficiaries. Teaching hospitals covered by this system receive about 30 percent of their revenues for inpatient services from Medicare. A portion of these payments stems from the "indirect teaching adjustment," which the Congress included in the PPS to account for the extra costs of caring for Medicare patients at the approximately 1,100 teaching hospitals where interns and residents are trained.1/ Payments based on this adjustment are expected to total $2.4 billion, or roughly 5 percent, of the $50 billion of all PPS payments in 1990. The 200 or so largest teaching hospitals will receive about $1.3 billion.

This indirect adjustment for medical education deserves careful scrutiny for two reasons. First, the underlying philosophy of the PPS is that payments should reflect "legitimate" differences in the costs of treating Medicare patients--namely, those that are beyond the individual hospital's control. Thus, setting the teaching adjustment correctly is an integral part of incorporating this philosophy in the reimbursement system. Second, one way to respond to the deficit targets set forth in the Balanced Budget Act is to constrain the high and rapidly growing expenditures for Medicare.

Determining the appropriate level for the indirect teaching adjustment is not a simple matter, however, because the adjustment is closely related to other features of the PPS, especially the adjustment that pays more to hospitals that treat a high

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1. The teaching adjustment is termed "indirect" because it reflects the higher costs of providing care for Medicare's enrollees when interns and residents are involved; it does not reflect the direct costs of medical education. The latter costs--which include salaries of residents, costs for classrooms, and allocated overhead expenses--are reimbursed under separate provisions outside the PPS.

proportion of low-income patients. Moreover, other factors than cost--such as ensuring access to care for Medicare beneficiaries and others--may be important in determining PPS reimbursements. Finally, understanding the extent to which medical education programs raise the costs of providing care for Medicare patients requires resolving complex statistical issues.

This paper discusses three topics:

- The development of the indirect teaching adjustment;
- Alternative estimates of the appropriate adjustment based on different assumptions and data; and
- The effects of lowering the current teaching adjustment on hospitals and on the federal budget.

BACKGROUND

In 1983, the Congress changed Medicare's system of paying for inpatient hospital services from a retrospective, cost-based reimbursement system to the PPS. Under this system, a hospital's payment for each discharged patient is predetermined and can be quite different from the hospital's actual costs. The Congress believed the new system would alleviate two serious problems caused by Medicare's previous

cost-based system: inefficiency on the part of hospitals and lack of federal control over expenditures for hospital care.

The prospective payment rates for each hospital are based on several cost-related factors believed to be outside the individual hospital's control. First, basic rates are calculated for 474 diagnosis-related groups (DRGs), with separate sets determined for urban and rural hospitals. These amounts are then adjusted for three factors: differences in wage levels in various geographic areas, the greater costs of providing care for Medicare patients in hospitals with teaching programs, and the higher costs related to treating a disproportionately large share of low-income patients. Finally, additional "outlier" payments are calculated for cases that involve extremely long hospital stays or that are exceptionally expensive.

The indirect teaching adjustment is justified in two ways. First, providing care may be more costly precisely because the hospital has a teaching program. For example, interns and residents may order more tests than experienced physicians. Second, teaching hospitals may have other characteristics that are also associated with higher costs but that are not used in calculating the PPS rates. For example, teaching hospitals may treat patients who are more severely ill than average; also, they are often located in high-cost central cities.

Under the PPS, the size of a teaching program is measured by the hospital's ratio of the number of interns and residents to the number of beds (IRB). For example, a hospital with no interns, 100 residents, and 400 beds would have an IRB of 0.25. In the early 1980s, the Health Care Financing Administration (HCFA)

estimated that raising the PPS rates by 5.79 percent for each 0.10 increase in the IRB would compensate teaching hospitals for the higher costs of providing care associated with the presence of medical education programs. The Congress set the initial teaching adjustment at twice that amount--that is, at 11.59 percent for each 0.10 increase in the IRB, often referred to as a "10 percent" increase.2/ The explicit rationale for a higher adjustment was to compensate teaching hospitals for other factors associated with having teaching programs--factors that legitimately increase the costs of treating Medicare patients but that were not otherwise accounted for in the system.

Under the Consolidated Omnibus Budget Reconciliation Act of 1985 (COBRA), the Congress added an explicit adjustment to account for the higher Medicare costs of providing care at hospitals with a disproportionately large share of low-income patients--commonly called "disproportionate share" hospitals. One rationale for these higher payments is that low-income Medicare patients are sicker and, therefore, more expensive to treat than other Medicare patients. Another rationale is that hospitals with large numbers of low-income patients--regardless of

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2. The level of the teaching adjustment has been described historically in terms of the percentage increase in PPS payments resulting from a 10 percent increase in the IRB. Because the initial adjustment was linear, the percentage rise in payments was the same whether the IRB increased from 0.1 to 0.2 or from 0.2 to 0.3. Each was considered to be a "10 percent" change. In 1986, the adjustment was made nonlinear. In other words, the percentage increase in payments related to the IRB increasing from 0.1 to 0.2 is now larger than when the IRB rises from 0.2 to 0.3. By convention, the nonlinear adjustment is described by the percentage increase in payments that would occur if the IRB increased slightly from zero, multiplied by the amount necessary to characterize the IRB increase as "10 percent." For example, if a 1,000 bed hospital acquired one resident, the IRB would increase from zero to 0.001 and under current law payments would rise by 0.077 percent. To characterize the increase in the IRB as "10 percent," however, it would have to be multiplied by 100 (0.001 x 100 = 0.10). Hence, the current adjustment is described as 7.7 percent (0.077 x 100 = 7.7).

whether they are Medicare enrollees--may provide additional staffing, facilities, and services in response to such patients' needs.3/

The Congress recognized both rationales when it designed the disproportionate share adjustment. That adjustment is based on an index that is the sum of two ratios. The first ratio is the proportion of all Medicare patient days that are attributable to Medicare patients receiving Supplemental Security Income (SSI), a means-tested cash benefit program for the elderly and disabled. The second ratio is the proportion of all patient days for which Medicaid is the primary payer. The first ratio is related to both rationales, while the second ratio reflects the second rationale by using the proportion of Medicaid patients as a measure of the share of low-income patients.4/

At the same time that the Congress added the disproportionate share adjustment, it reduced the indirect teaching adjustment to 8.1 percent, in part to reflect the specific targeting of additional payments for the higher costs associated with large shares of low-income patients. More recently, under the Omnibus Reconciliation Act of 1987, the Congress once again cut the teaching adjustment,

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3. Another rationale for the disproportionate share adjustment is to help certain hospitals that are in poor financial condition because they serve a large proportion of patients for whom reimbursements are lower than costs of treatment. (This situation arises when patients do not pay all of the charges for which they are responsible or when third-party reimbursement rates do not cover actual costs.) These financial problems, however, may not be reflected in higher Medicare costs per case at these hospitals.

4. Under 1989 law, urban hospitals with more than 100 beds and indexes of 0.15 or more, other urban hospitals with indexes of 0.40 or more, and rural hospitals with indexes of 0.45 or more are eligible for disproportionate share payments. The exact percentage increase in payment rates varies among these three categories of hospitals and, for large urban hospitals, it depends on the value of the index. In 1990, disproportionate share payments are expected to total about $1.2 billion, or 2.4 percent of all PPS payments. Large urban hospitals will receive roughly 97 percent of disproportionate share payments.

this time to 7.7 percent, in part to reflect new estimates of the indirect teaching adjustment based on 1984 data.

The teaching adjustment varies substantially among teaching hospitals based on the size of their medical education programs--that is, their IRBs--but it is not proportional. For example, a hospital with an IRB of 0.10 receives 7.4 percent more, while an IRB of 0.20 raises payments 14.5 percent and an IRB of 0.50 increases them 33.7 percent. The median teaching hospital has 8 interns and residents for each 100 beds, or an IRB of 0.08. About 10 percent of teaching hospitals have IRBs under 0.01, and 75 percent have IRBs under 0.18. The 10 percent of teaching hospitals with the largest IRBs have values of 0.35 or more, but almost no hospitals have IRBs over 0.80.

Table 1 shows information about PPS payments to hospitals with selected characteristics. About 20 percent have teaching programs, but these hospitals are projected to account for over 40 percent of all PPS cases and to receive 50 percent of all PPS payments in 1990.

The roughly 200 hospitals with IRBs of 0.25 or more are commonly called "major" teaching hospitals. Their average payment per case is $8,000, or twice that for nonteaching hospitals. Indirect teaching payments of $1,640 per case, however, account for only about 40 percent of the $4,000 difference in payment. These largest teaching hospitals receive more than half of all teaching payments, even though they account for less than 20 percent of the cases treated at teaching hospitals. Average payments to hospitals with IRBs less than 0.25, commonly called

TABLE 1. ESTIMATED PPS PAYMENTS BY SELECTED CHARACTERISTICS OF HOSPITALS (Fiscal year 1990)

	Hospitals (In percent)	Cases (In percent)	Payments (In percent)		Payments Per Case		
			Total	Teaching	Total (In dollars)	Teaching (In dollars)	Teaching (As a percent of total)
All Hospitals	100.0	100.0	100.0	100.0	4,780	230	4.8
Teaching	19.5	41.2	50.6	100.0	5,870	560	9.6
Nonteaching	80.5	58.8	49.4	0.0	4,020	0	0.0
Teaching							
Major (IRB ≥.25)	3.5	7.8	13.1	55.4	8,010	1,640	20.4
Minor (IRB <.25)	16.1	33.3	37.4	44.6	5,360	310	5.8
IRB <.05	7.2	13.5	13.8	4.6	4,870	80	1.6
IRB .05-.009	3.9	7.9	8.7	8.8	5,230	260	4.9
IRB .10-.249	5.0	11.9	15.0	31.2	6,020	610	10.1
Teaching							
Disproportionate share	8.8	17.6	24.1	59.8	6,530	780	12.0
Nondisproportionate share	10.7	23.5	26.5	40.2	5,370	400	7.4
Nonteaching							
Disproportionate share	13.6	12.1	11.4	0.0	4,510	0	0.0
Nondisproportionate share	66.9	46.7	38.0	0.0	3,890	0	0.0
Disproportionate share	22.4	29.8	35.5	59.8	5,710	460	8.1
Nondisproportionate share	77.6	70.2	64.5	40.2	4,390	130	3.0
Urban	52.3	76.7	84.7	98.0	5,280	300	5.6
Rural	47.7	23.3	15.3	2.0	3,130	20	0.6
Urban							
<100 beds	14.5	5.2	4.5	0.7	4,100	30	0.8
100-199 beds	14.3	13.6	13.1	3.9	4,620	70	1.4
200-299 beds	11.0	19.6	20.6	12.6	5,020	150	3.0
300-399 beds	6.0	14.6	16.1	16.6	5,290	260	5.0
≥400 beds	6.6	23.7	30.4	64.2	6,130	630	10.2
Rural							
<200 beds	45.3	18.8	11.7	0.5	2,990	10	0.2
≥200 beds	2.4	4.6	3.6	1.5	3,720	80	2.1
Geographic Location							
MSA ≥1 million a/	23.3	36.2	43.4	65.4	5,740	420	7.3
Other urban b/	28.6	40.1	40.9	32.6	4,880	190	3.9
Rural referral c/	3.7	5.9	4.7	1.8	3,790	70	1.9
Other rural d/	38.2	15.1	9.0	0.2	2,840	f/	0.1
Sole community e/	6.3	2.7	2.0	0.0	3,520	f/	0.1

	All Hospitals						
	(In thousands)	(In millions)	(In billions of dollars)	(In billions of dollars)	(In dollars)	(In dollars)	(As a percent of total)
	5.6	10.5	50.1	2.4	4,780	230	4.8

SOURCE: Congressional Budget Office estimates based on data from the Health Care Financing Administration and other sources.

a. MSAs are metropolitan statistical areas.

b. Other urban hospitals are those located in MSAs containing less than 1 million people that are not sole community hospitals.

c. Rural referral hospitals are located in rural areas and must meet at least one of several other conditions. One is that they could have 275 or more beds. Second, they could have at least 50 percent of their Medicare patients referred from other hospitals, and have at least 60 percent of their Medicare admissions consist of--and provide at least 60 percent of their Medicare services to--beneficiaries who live more than 25 miles from the hospital. The third condition is that they could meet a group of other criteria that make them similar to urban hospitals. Payments to rural referral hospitals are determined by the urban basic rates rather than the rural ones.

d. Other rural hospitals are located in rural areas but are neither rural referral nor sole community hospitals.

e. Sole community hospitals are hospitals that because of factors such as isolated location, weather conditions, travel conditions, or absence of other hospitals are the sole source of inpatient services reasonably available in a geographic area. These hospitals are paid prospectively, but only 25 percent of their payment is based on the regional PPS rates. The other 75 percent is based on the hospital's own historical costs indexed for inflation.

f. Less than $5.

"minor" teaching hospitals, are considerably lower than for major teaching hospitals, but they are above nonteaching hospitals.

Teaching hospitals tend to have certain characteristics in common. For example, they are seldom located in rural areas and are especially likely to be located in the largest metropolitan statistical areas (MSAs), to have 400 or more beds, and to treat large shares of low-income patients. For this reason, almost 98 percent of all teaching payments goes to urban hospitals and about 65 percent goes to hospitals in the largest MSAs. Hospitals with 400 or more beds get more than 65 percent of all teaching payments, and disproportionate share hospitals receive almost 60 percent of them.

ESTIMATING THE TEACHING ADJUSTMENT

Estimating the indirect impact of teaching programs on hospitals' costs for treating Medicare patients is difficult and requires many technical decisions.

The Data and the Statistical Models

Data from five years were available to the Congressional Budget Office (CBO) for its analysis--1981, 1984, 1985, 1986, and 1987. Because it is not clear which year is best for policy purposes, CBO estimated the statistical models using data from each year. The 1981 data might be preferred because they were used initially to assist

the Congress in designing the original PPS. In contrast, data from the other years would reflect more recent experiences of hospitals. Also, reported values for some of the PPS variables--for example, the index used to measure the complexity of cases treated by hospitals--may be more accurate in recent years when these variables affected the revenues of hospitals compared with 1981 when they did not. On the other hand, the data from more recent years may reflect responses to incentives under the PPS and to changes in other payers' reimbursement systems. For example, some hospitals may have lower total revenues because of stricter cost controls by private insurers and a growing caseload of uninsured patients. They would have to lower their expenditures--that is, their costs--even if doing so reduced the quality of care or the effectiveness of their training programs. In this case, using recent data would not correctly measure costs related to treating large shares of low-income patients or the underlying indirect costs of teaching activity.

CBO designed several statistical models for this analysis. Its first step in designing them was to identify the purpose each was to serve. One possibility was to attempt to isolate the "pure" effect of teaching on Medicare's cost per case by accounting for the factors thought to influence these costs, regardless of whether they are used in calculating PPS payments. This type of model is typical of the approach health economists have taken for years to explain what determines hospitals' costs. HCFA also used this approach to estimate the adjustments proposed at the inception of the PPS. This paper uses the term "complete" models to refer to this type of model.

Separating a pure teaching effect from other factors is complicated, because many teaching hospitals share characteristics that are also associated with high costs, such as being located in high-wage areas. The relationship between costs and the size of teaching programs can easily be overstated if the analysis takes into account too few of the other factors. On the other hand, including too many explanatory variables--for example, the ratio of the number of registered nurses to the number of beds--may lead to understating the indirect teaching effect by attributing the higher costs to other closely related factors, when in fact they actually result from the presence of teaching programs.

The second type of statistical estimating model--often referred to as a "payment" model--is generally used to identify appropriate levels for the adjustments on which PPS payments are based. Thus, payment models consider only factors that are actually used by the PPS. An example of the difference between the two approaches is the treatment of hospitals located in the central cities of MSAs. These hospitals may face additional legitimate costs for treating Medicare patients as a result of factors such as higher wage rates than are paid by hospitals located in the suburbs. A complete model might separate that particular effect from the impact of teaching programs on costs. In contrast, a payment model would attribute some or all of the effect to the presence of teaching programs, since the PPS does not distinguish among hospitals located in different parts of metropolitan areas.

In essence, using an estimate from a complete model would represent a decision to base PPS payments on the narrowest interpretation of teaching programs as a source of higher legitimate costs. On the other hand, using an estimated

adjustment from a payment model would compensate hospitals for a host of unspecified factors associated with teaching hospitals but not otherwise represented in the payment system.5/ The choice among models is a policy judgment between narrow and broad interpretations of what are considered to be "legitimate" costs associated with being a teaching hospital and that, therefore, warrant an increase in PPS payments.

For its analysis, CBO estimated two "complete" models (see the appendix for the variables used in the complete models and the payment models). The first complete model (referred to as "basic") took nonteaching factors into account by including the case mix index, wage index, number of beds, and size of the metropolitan area.6/ This model resembles the one estimated by HCFA before the Congress enacted the PPS.7/ The second model (referred to as "expanded") included some additional explanatory characteristics, such as the ownership of the hospital (public, private nonprofit, or proprietary), and more detailed information on other characteristics, such as where each hospital is located.

CBO also estimated two payment models. The first included only factors used by the PPS, and CBO took them into account in exactly the way the Congress

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5. An alternative view of a payment model is that it attempts to ensure that hospitals with certain characteristics (in this case, hospitals with teaching programs), as a group, will be held harmless by the payment system. In other words, the payment model estimates approximately how much more teaching hospitals must be paid so that, on average, their PPS payments will equal their costs.

6. A hospital's "case mix" is a number that reflects the amount of resources needed to treat its Medicare patients. It is based on the distribution of the hospital's patients among the various DRGs. A hospital's "wage index" is an estimate of the average wages paid by hospitals in that locality compared with the national average of hospitals' wages.

7. The HCFA model was estimated using unweighted data. CBO estimates, however, are based on discharge-weighted data.

has legislated for 1989, except that the teaching adjustment was allowed to vary from its current level. For example, this payment model reflects the fact that hospitals located in MSAs containing 1 million or more people have PPS rates that are 1 percent higher in 1989 than identical hospitals located in smaller MSAs, even though the PPS system did not include this differential until 1988. If CBO had instead used the PPS provisions actually in effect in each year for which data were available, the estimates would have represented the higher costs of patient care associated with the presence of teaching programs and not accounted for by those payment systems. Consequently, such estimates would not have been relevant when considering the appropriateness of the current adjustment, which is part of the 1989 PPS.

The second payment model is identical to the first, except that both the teaching adjustment and the disproportionate share adjustment were allowed to vary from their legislated values. Consequently, CBO's analysis simultaneously determined two impacts on Medicare costs--that of teaching programs and that of serving disproportionately many low-income patients. (Alternative ways of measuring teaching activity or "disproportionate share" were not examined, however; both were defined as under current law.) This approach is of particular interest, since both times the Congress has set the disproportionate share adjustment, it has also changed the teaching adjustment to reflect the association between them.

Alternative Estimates of the Teaching Adjustment

As shown in Table 2, the estimates of the indirect teaching adjustment range from 3.5 percent to 9.5 percent, depending on the particular model and year. All of the estimates based on data from 1985 through 1987 are below the current adjustment of 7.7 percent, while five of the eight estimates based on 1981 or 1984 data are above that level.

TABLE 2. ESTIMATED INDIRECT TEACHING ADJUSTMENTS BASED ON SELECTED STATISTICAL MODELS AND YEARS OF DATA
(In percent)

	Data from Fiscal Year				
	1981	1984	1985	1986	1987
Complete Models					
Basic	8.3	7.8	7.2	5.8	5.2
Expanded	6.6	6.9	6.0	5.5	4.6
Payment Models					
1989 law	8.5	6.8	6.2	3.8	3.5
1989 law except for disproportionate share adjustment	9.5	8.1	7.6	4.9	5.1

SOURCE: Congressional Budget Office estimates based on data from the Health Care Financing Administration and other sources.

NOTE: Data for each hospital were adjusted to correspond to federal fiscal years and were weighted by the number of Medicare patients discharged from the hospitals.

Several other patterns are apparent. First, the estimated teaching effect using a complete model is always larger in the basic case than in the expanded one--8.3 percent compared with 6.6 percent, for example, using 1981 data. This pattern is predictable because the smaller model attributes some higher costs to the presence of teaching programs, whereas these costs are more closely related to factors that are explicitly represented by specific variables in the larger model. For instance, the expanded model directly takes into account the additional Medicare costs of treating a high proportion of poor patients, while the basic model does not.

Second, the estimated level of the adjustment is always lower for one payment model--the one in which the disproportionate share adjustment represents current law--than in the other payment model where the disproportionate share adjustment is allowed to vary from its legislated values. If 1981 data were used, for example, the adjustment would be 8.5 percent compared with 9.5 percent. This difference results because the disproportionate share adjustment now increases payments to qualifying hospitals by more than the data indicate is necessary to offset their higher costs when the current definition of the disproportionate share index is used. Consequently, when the disproportionate share adjustment is not allowed to vary (as in the third line of Table 2), that payment model attempts to offset the higher disproportionate share payments by lowering the estimated indirect teaching adjustment. In contrast, in the other payment model, the data determine both adjustments simultaneously (see the fourth line of Table 2).

Paying for the higher costs associated with teaching programs by using the disproportionate share adjustment is not equivalent, however, to paying for them by

using the teaching adjustment, since the two groups of hospitals are not the same. More than 30 percent of the disproportionate share payments go to nonteaching hospitals, while more than half of the teaching hospitals do not receive any disproportionate share payments.

Table 2 illustrates a final pattern--namely, that more recent data suggest lower teaching adjustments than do earlier data. The estimate declines, for example, from 9.5 percent using 1981 data to 5.1 percent using 1987 data for the second payment model. This trend occurs for both the complete models and the payment models, but its causes are not apparent. (CBO plans to undertake further analysis of the causes behind these trends. Specifically, it plans to examine factors such as improvements in DRG coding, changes in occupancy rates, financial pressures on hospitals deriving from cuts in other payers' reimbursements, and responses by hospitals to PPS incentives. A better understanding of these factors would be important, for example, in evaluating the appropriateness of using data from various years.)

MODIFYING THE TEACHING ADJUSTMENT

One argument for lowering the indirect teaching adjustment is that doing so would better align teaching payments with the additional Medicare costs associated with the presence of teaching programs, as estimated above using information from 1985 to 1987. On the other hand, teaching hospitals would have to respond to their lower revenues by cutting back some activities if they were unable to operate more efficiently.

If the teaching adjustment were cut, the Congress would also have to decide whether or not to restructure the disproportionate share adjustment to recognize the interaction between it and the teaching adjustment, as it has done in the past. Because a complete analysis of such a change is beyond the scope of this paper, it presents only illustrative reductions in the disproportionate share adjustment. In each case, the current definition of the disproportionate share index is retained, but the percentage increases in PPS payments for hospitals with particular values of the index are cut. A reduction in the disproportionate share adjustment might better align payments with the estimated costs of having a high proportion of low-income patients. On the other hand, a lower adjustment would reduce the revenues of these hospitals, thereby exacerbating the problems of some financially troubled, inner-city hospitals, which serve many of the nation's uninsured.

Finally, if the indirect teaching adjustment were lowered, the Congress would have to decide whether to return the savings to all hospitals by raising the basic payment rates, or to use some or all of the savings for another purpose such as deficit reduction. The former approach would be in keeping with the original financing of the indirect teaching adjustment, which lowered payment rates for all hospitals rather than increasing total outlays. On the other hand, since 1985, expenditures by hospitals have risen far more quickly than the prices of the inputs they purchase, which suggests that their previous gains in efficiency may have been lost. Reducing the teaching adjustment without a rebate to all hospitals would, therefore, be a step toward reinstating the original incentives of the PPS for hospitals to provide care more efficiently.

The remainder of this paper examines some specific illustrations of ways the indirect teaching adjustment might be modified. Because CBO's analysis indicates that the adjustment might be changed only slightly or lowered by more than four percentage points, the impacts of three illustrative levels are described--7 percent, 5 percent, and 3 percent. The options also vary according to whether the basic payment rates would be raised and whether the disproportionate share adjustment would be changed.

Lower the Teaching Adjustment and Return the Savings to All Hospitals

If the basic payment rates were increased so that savings from a lower teaching adjustment were returned to all hospitals, and if the disproportionate share adjustment were continued as in 1989, the average level of payments to all hospitals would remain the same (see the first three entries in the first row in Table 3). If the teaching adjustment were set at 7 percent, 5 percent, or 3 percent, payments to nonteaching hospitals--which would gain from the higher basic rates--would increase by 0.4 percent, 1.7 percent, or 3.0 percent, respectively. In aggregate, teaching hospitals would lose about the same percentages, since they now receive roughly 50 percent of total PPS payments. The impact, however, would vary within the group of teaching hospitals. While each teaching hospital would receive less through the teaching adjustment, for those with relatively small teaching programs, the increase in the basic rates would more than offset this reduction. Thus, their total payments would rise. In contrast, hospitals with more intensive teaching programs would receive lower total PPS payments--major teaching hospitals would receive 5.5 percent less if the teaching adjustment were lowered to 5 percent, for example.

TABLE 3. ESTIMATED CHANGE IN PPS PAYMENTS TO HOSPITALS FOR ILLUSTRATIVE LEVELS OF BOTH THE INDIRECT TEACHING ADJUSTMENT AND THE DISPROPORTIONATE SHARE ADJUSTMENT IF BASIC RATES WERE INCREASED (As a percentage of total payments under current law, in fiscal year 1990)

	No Change in the Disproportionate Share Adjustment			Reduction in the Disproportionate Share Adjustment		
	Teaching Adjustment			Teaching Adjustment		
	7	5	3	7	5	3
All Hospitals	0.0	0.0	0.0	0.0	0.0	0.0
Teaching	-0.4	-1.7	-2.9	-1.0	-2.1	-3.1
Nonteaching	0.4	1.7	3.0	1.0	2.1	3.2
Teaching						
Major (IRB >.25)	-1.3	-5.5	-9.7	-3.8	-7.4	-10.7
Minor (IRB <.25)	-0.1	-0.3	-0.5	0.0	-0.2	-0.5
IRB <.05	0.3	1.2	2.0	0.5	1.4	2.3
IRB .05-.099	0.0	0.0	0.0	0.2	0.1	0.0
IRB .10-.249	-0.4	-1.8	-3.2	-0.6	-1.9	-3.2
Teaching						
Disproportionate share	-0.6	-2.5	-4.5	-3.4	-4.6	-5.4
Nondisproportionate share	-0.2	-0.9	-1.5	1.3	0.2	-1.0
Nonteaching						
Disproportionate share	0.4	1.7	3.0	-1.8	0.0	2.2
Nondisproportionate share	0.4	1.7	3.0	1.8	2.8	3.5
Disproportionate share	-0.3	-1.1	-2.0	-2.9	-3.1	-3.0
Nondisproportionate share	0.2	0.6	1.1	1.6	1.7	1.6
Urban	-0.1	-0.2	-0.4	-0.3	-0.4	-0.5
Rural	0.3	1.4	2.4	1.7	2.4	2.9
Urban						
<100 beds	0.3	1.4	2.5	1.8	2.5	3.1
100-199 beds	0.3	1.2	2.2	-0.2	0.9	2.0
200-299 beds	0.2	0.7	1.2	0.1	0.6	1.2
300-399 beds	0.0	0.0	-0.1	-0.2	-0.2	-0.2
≥400 beds	-0.5	-1.9	-3.3	-1.0	-2.3	-3.5
Rural						
<200 beds	0.4	1.5	2.7	1.7	2.5	3.2
≥200 beds	0.2	0.9	1.6	1.6	1.9	2.1
Geographic Location						
MSA ≥1 million a/	-0.2	-0.8	-1.5	-0.6	-1.1	-1.6
Other urban b/	0.1	0.4	0.7	0.0	0.3	0.6
Rural referral c/	0.3	1.1	1.9	1.6	2.1	2.4
Other rural d/	0.4	1.7	3.0	1.9	2.8	3.6
Sole community e/	0.1	0.4	0.7	0.4	0.6	0.8

SOURCE: Congressional Budget Office estimates based on data from the Health Care Financing Administration and other sources.

NOTE: See notes to Table 1.

To examine the combined impacts of restructuring the disproportionate share adjustment and setting the teaching adjustment at 7 percent, 5 percent, or 3 percent, CBO also designed three illustrative disproportionate share adjustments, each of which retained the current definition of the disproportionate share index. These adjustments were based on statistical analyses similar to those reported above.8/ For urban hospitals having 100 beds or more, all three adjustments would apply only when a hospital's disproportionate share index was 0.20 or more, compared with a threshold of 0.15 under current law.9/ Thus, only about 60 percent of large urban hospitals that now receive disproportionate share payments would continue to receive them under these illustrations. Moreover, the percentage adjustments to the basic PPS payments of qualifying hospitals would be smaller than they are now. As a result of both factors, total disproportionate share payments would fall by roughly 60 percent, 45 percent, or 20 percent of the current level, respectively, if the teaching adjustment were set at 7 percent, 5 percent, or 3 percent.

The three right-hand columns of Table 3 show the impact of cutting both the teaching and the disproportionate share adjustments while, at the same time, raising the basic payment rates enough to return the savings to all hospitals. Some adversely affected hospitals would receive even lower payments, but others would gain even more than if only the teaching adjustment were lowered. The net impact for any group of hospitals would depend on the relative sizes of the different

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8. The particular analyses used to determine the illustrative disproportionate share adjustments allowed that adjustment to be determined by the data, but set the indirect teaching adjustment at 7 percent, 5 percent, and 3 percent, respectively.

9. Because small urban and rural hospitals receive only about 3 percent of current disproportionate share payments, their adjustments were not changed for these illustrations.

effects--the increase in basic payments compared with any reduction in teaching and disproportionate share payments.

In these illustrations, payments to nonteaching hospitals would rise 1.0 percent, 2.1 percent, or 3.2 percent, respectively, as larger reductions in the teaching adjustment were made. These increases would occur because of higher basic rates and because nonteaching hospitals generally have lower shares of low-income patients. Teaching hospitals with IRBs of 0.10 and above would receive less in each illustration, but those with the least intensive programs would gain. Teaching hospitals that do not receive disproportionate share adjustments would not be affected nearly as much as hospitals receiving both adjustments. The latter group would lose between 3.4 percent and 5.4 percent of their total PPS payments, depending on the cut in the teaching adjustment.

Lower the Teaching Adjustment
and Use the Savings for Other Purposes

Substantial savings in Medicare outlays would be realized, if some or all of the reduced payments to teaching hospitals were not offset by increases in the basic PPS rates. If the basic rates were unchanged, savings in 1990 would range from $180 million if the teaching adjustment were set at 7 percent to $1.3 billion if the teaching adjustment were set at 3 percent, and would be noticeably higher in subsequent years (see the upper panel of Table 4). Alternatively, if the disproportionate share adjustment were scaled back at the same time, savings in 1990 would rise to between $750 million and $1.5 billion, under the three illustrations (see the lower panel of Table 4).

Table 5 shows the percentage reduction in PPS payments to selected groups of hospitals that would occur if all the savings from a lowered teaching adjustment were used to cut the federal budget deficit. If the disproportionate share adjustment were unchanged, payments to nonteaching hospitals would remain the same, but all teaching hospitals would receive less (see the three left-hand columns of Table 5).

TABLE 4. BUDGET SAVINGS FROM ILLUSTRATIVE REDUCTIONS IN THE INDIRECT TEACHING ADJUSTMENT AND THE DISPROPORTIONATE SHARE ADJUSTMENT (By fiscal year, in millions of dollars)

	1990	1991	1992	1993	1994	Cumulative Five-Year Savings
Reduce Only the Teaching Adjustment						
Seven Percent	180	230	250	280	300	1,200
Five Percent	750	940	1,030	1,130	1,230	5,100
Three Percent	1,320	1,640	1,810	1,980	2,150	8,900
Reduce Both the Teaching Adjustment and the Disproportionate Share Adjustment						
Seven Percent a/	750	950	1,040	1,150	1,240	5,100
Five Percent b/	1,180	1,480	1,620	1,770	1,930	8,000
Three Percent c/	1,510	1,890	2,090	2,290	2,480	10,300

SOURCE: Congressional Budget Office.

NOTE: The savings in each year reflect the lags in reimbursement that arise because payments for some patients are made in the year after treatment actually occurred.

a. Under this option, total disproportionate share payments would be reduced by about 60 percent, or by roughly $3.9 billion, over the five-year period.

b. Under this option, total disproportionate share payments would be reduced by about 45 percent, or by roughly $2.9 billion, over the five-year period.

c. Under this option, total disproportionate share payments would be reduced by about 20 percent, or by roughly $1.4 billion, over the five-year period.

Major teaching hospitals would experience the largest reductions--1.7 percent, 7.1 percent, or 12.4 percent, respectively, under the three illustrations. In fact, most categories of hospitals would get lower PPS payments, since most of them contain at least a few teaching hospitals. Disproportionate share hospitals, urban hospitals with 400 or more beds, and those in large MSAs would receive the biggest cuts, since these categories overlap the most with large teaching hospitals. Rural hospitals, particularly those with less than 200 beds, would lose the least.

If the disproportionate share adjustment were also scaled back, more hospitals would be adversely affected (see the three right-hand columns of Table 5). The 40 or so major teaching hospitals located in large MSAs that also qualify for the disproportionate share adjustment would lose the most--11.9 percent, 15.3 percent, or 17.9 percent, respectively, for teaching adjustments of 7 percent, 5 percent, or 3 percent. These losses and, hence, the impact on the financial status of these hospitals would be greater than the average that would be experienced by major teaching hospitals. The latter group would lose 5.6 percent, 10.0 percent, and 13.9 percent, respectively, depending on the cut in the teaching adjustment, as shown in Table 5.

TABLE 5. ESTIMATED CHANGE IN PPS PAYMENTS TO HOSPITALS FOR ILLUSTRATIVE LEVELS OF BOTH THE INDIRECT TEACHING ADJUSTMENT AND THE DISPROPORTIONATE SHARE ADJUSTMENT IF BASIC RATES WERE NOT CHANGED (As a percentage of total payments under current law, in fiscal year 1990)

	No Change in the Disproportionate Share Adjustment			Reduction in the Disproportionate Share Adjustment		
	Teaching Adjustment			Teaching Adjustment		
	7	5	3	7	5	3
All Hospitals	-0.4	-1.7	-2.9	-1.8	-2.7	-3.4
Teaching	-0.8	-3.3	-5.8	-2.8	-4.8	-6.5
Nonteaching	0.0	0.0	0.0	-0.8	-0.6	-0.3
Teaching						
Major (IRB >.25)	-1.7	-7.1	-12.4	-5.6	-10.0	-13.9
Minor (IRB <.25)	-0.5	-2.0	-3.5	-1.9	-3.0	-3.9
IRB <.05	-0.1	-0.6	-1.0	-1.3	-1.4	-1.3
IRB .05-.099	-0.4	-1.7	-3.0	-1.6	-2.6	-3.5
IRB .10-.249	-0.9	-3.5	-6.1	-2.5	-4.7	-6.6
Teaching						
Disproportionate share	-1.0	-4.2	-7.3	-5.2	-7.3	-8.8
Nondisproportionate share	-0.6	-2.5	-4.5	-0.6	-2.5	-4.5
Nonteaching						
Disproportionate share	0.0	0.0	0.0	-3.6	-2.7	-1.4
Nondisproportionate share	0.0	0.0	0.0	0.0	0.0	0.0
Disproportionate share	-0.7	-2.8	-5.0	-4.7	-5.8	-6.4
Nondisproportionate share	-0.3	-1.0	-1.8	-0.3	-1.0	-1.8
Urban	-0.5	-1.9	-3.4	-2.2	-3.2	-4.0
Rural	-0.1	-0.2	-0.4	-0.1	-0.2	-0.4
Urban						
<100 beds	-0.1	-0.3	-0.5	-0.1	-0.3	-0.5
100-199 beds	-0.1	-0.5	-0.9	-2.0	-1.9	-1.6
200-299 beds	-0.3	-1.0	-1.8	-1.8	-2.2	-2.3
300-399 beds	-0.4	-1.7	-3.0	-2.0	-2.9	-3.7
≥400 beds	-0.9	-3.5	-6.2	-2.9	-5.0	-6.9
Rural						
<200 beds	0.0	-0.1	-0.1	-0.1	-0.1	-0.2
≥200 beds	-0.2	-0.7	-1.2	-0.2	-0.7	-1.2
Geographic Location						
MSA ≥1 million a/	-0.6	-2.5	-4.4	-2.4	-3.8	-5.0
Other urban b/	-0.3	-1.3	-2.3	-1.9	-2.5	-2.9
Rural referral c/	-0.2	-0.7	-1.1	-0.3	-0.7	-1.2
Other rural d/	0.0	0.0	-0.1	0.0	0.0	-0.1
Sole community e/	0.0	0.0	-0.1	0.0	0.0	-0.1

SOURCE: Congressional Budget Office estimates based on data from the Health Care Financing Administration and other sources.

NOTE: See notes to Table 1.

APPENDIX: A DESCRIPTION OF THE STATISTICAL MODELS

This appendix briefly describes the four statistical models CBO estimated for this analysis. Each model was estimated in the "double logarithm" form--that is, on the left-hand side of the equation is the logarithm of Medicare costs per case and on the right-hand side is the logarithm of continuous variables such as the case mix index, the wage index, the number of beds, and the IRB.1/ This functional form implies a multiplicative relationship between costs and the continuous explanatory variables. The simple two-variable relationship is:

$$Y = aX^b$$

If the logarithm of both sides of the equation is taken, the resulting functional form:

$$Log(Y) = Log(a) + bLog(X)$$

is linear. Furthermore, "b"--the coefficient of Log(X)--can be interpreted as the percent change in Y associated with a 1 percent change in X. For this reason, if the coefficient of the expression Log(1+IRB) is 0.77, the teaching effect is conventionally described as 7.7 percent (a 0.77 percent change in costs per case for a 1 percent change in the sum of 1 plus the IRB is the same as a 7.7 percent change in costs per case corresponding to a 10 percent change in the sum).2/

Table A-1 defines the variables used in any of the models, while Table A-2 shows which ones were included in each model. "U" indicates that the variable was

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1. Dummy variables were not transformed by taking logarithms.

2. The coefficient of a dummy variable has a slightly different interpretation: it corresponds to the percentage change in costs per case associated with the dummy variable having a value of 1.0. For example, a coefficient of .01 on the dummy variable, BIGCITY, indicates that a hospital located in a large MSA has approximately 1 percent higher costs than a hospital located in a smaller MSA.

included in the model and its regression coefficient was not restricted. "R" indicates that the variable was included, but its coefficient was restricted to the legislated value for 1989. For example, in both payment models, the BIGCITY coefficient was set at its legislated value of 0.01. Finally, "-" indicates that the variable was omitted from the model altogether. For example, MEDCITY was omitted from both payment models.

CBO estimated each of the four models by using data about various hospital characteristics from each year--1981, 1984, 1985, 1986, and 1987--whenever they were available.3/ The dependent variable--Medicare costs per case--was available for each year. Among the explanatory variables, the case mix index was also available for each year. The ratio of the number of interns and residents to the number of beds (IRB) was only available for two years: 1984 and 1987. The 1984 values were used with the 1981, 1984, and 1985 data. The 1987 values were used with the 1986 and 1987 data. Sensitivity analyses indicate that the choice of the IRB variable did not affect the estimates. The remaining explanatory variables change relatively little over time, so the best quality data were used, usually 1987 values.

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3. The estimates in Table 2 are based on using the maximum number of hospitals for which data were available in each year. Alternative estimates of the teaching adjustment--based on using a matched set of the same hospitals for each year--were approximately the same.

TABLE A-1. DEFINITION OF VARIABLES USED IN CBO's STATISTICAL MODELS

CPC	Logarithm of Medicare costs per Medicare discharge.
CPCX	Logarithm of Medicare costs less outlier payments per Medicare discharge.
CONSTANT	Indicates that the model includes a constant term.
TEACH	Logarithm of (1 + IRB).
CMI	Logarithm of the case mix index.
WAGE	Logarithm of the Medicare wage index.
URBAN	A dummy variable (taking only "1" or "0" as its value) that indicates whether a hospital is located in an urban area or not.
MEDCITY	A dummy variable that indicates whether or not a hospital is located in an MSA with a population of more than 250,000, but less than 1 million.
BIGCITY	A dummy variable that indicates whether or not a hospital is located in an MSA with a population of 1 million or more.
DSP1	A dummy variable that indicates whether or not a hospital is a rural hospital with a disproportionate share index of 0.45 or greater.
DSP2	A dummy variable that indicates whether or not a hospital is an urban hospital with fewer than 100 beds and a disproportionate share index of 0.40 or greater.
DSP3	A dummy variable that indicates whether or not a hospital is an urban hospital with 100 or more beds and a disproportionate share index of 0.15 or greater.
DSP	The amount by which the disproportionate share index of a hospital exceeds 0.15. (Takes the value "0" for rural hospitals, urban hospitals with fewer than 100 beds, and urban hospitals with 100 or more beds whose index is less than 0.15.)

(continued)

TABLE A-1. (Continued)

XDSP1 to XDSP6	Six dummy variables that indicate whether or not an urban hospital with 100 or more beds has a disproportionate share index in one of six categories: ($0.15 \leq$ INDEX < 0.20), ($0.20 \leq$ INDEX < 0.25), ($0.25 \leq$ INDEX < 0.35), ($0.35 \leq$ INDEX < 0.45), ($0.45 \leq$ INDEX < 0.55), or (INDEX ≥ 0.55).
BEDS	Number of beds in each hospital. (In the basic model, the logarithm of BEDS was included instead of BEDS.)
BEDSSQ	The square of the number of beds (BEDS x BEDS).
C1 to C8	Eight dummy variables that indicate whether or not a hospital is located in one of eight regions defined by the U.S. Bureau of the Census.
PROP	A dummy variable that indicates whether or not a hospital is a for-profit hospital.
GOVT	A dummy variable that indicates whether or not a hospital is owned by the government.

TABLE A-2. VARIABLES INCLUDED IN CBO's FOUR STATISTICAL MODELS a/

	Complete Models		Payment Models	
	Basic	Extended	1989 Law b/	Exception c/
Dependent Variable	CPC	CPC	CPCX	CPCX
Explanatory Variables				
CONSTANT	U	U	U	U
TEACH	U	U	U	U
CMI	U	U	R	R
WAGE	U	U	R	R
URBAN	U	U	R	R
MEDCITY	U	U	-	-
BIGCITY	U	U	R	R
DSP1	-	U	R	U
DSP2	-	U	R	U
DSP3	-	-	R	-
DSP	-	-	R	-
XDSP1 to XDSP6	-	U	-	U
BEDS	U	U	-	-
BEDSSQ	-	U	-	-
C1 TO C8	-	U	-	-
PROP	-	U	-	-
GOVT	-	U	-	-

a. The table is coded with the following symbols:

"U" indicates that a variable was included in the model and not restricted to any particular value.

"R" indicates that a variable was included in the model, but restricted to the value indicated in 1989 law.

"-" indicates that a variable was excluded from the model.

b. The model is based on 1989 law, except that the indirect teaching adjustment was allowed to vary.

c. The model is based on 1989 law, except that both the indirect teaching adjustment and the disproportionate share adjustment were allowed to vary.